REMARKS

The present application includes claims 1, 4-9, 11-14 and 17-23. Claims 2-3, 10, and 15-16 were previously cancelled. The Office Action of July 22, 2008 apparently rejected all claims. Applicants request reconsideration of the claims in light of the discussion below.

Claim 1 was rejected under 35 U.S.C. § 102(e) as being anticipated by Kawagishi (U.S. Patent No. 6,663,565).

Claims 4, 8 and 12 were rejected under 35 U.S.C. 103(a) as obvious based on the combination of Kawagishi and Phillips (U.S. Patent No. 6,213,947).

Claims 5, 6, and 13 were rejected under 35 U.S.C. 103(a) as obvious based on Chiao '869 (U.S. Patent No. 5,984,869).

The Office Action was silent as to claims 7, 9, 11, 14 and 17-23. Applicants assume that these claims are rejected as discussed in the previous Office Action, or based on the newly cited reference, Kawagishi.

The present application includes three independent claims, 1, 9 and 14. Each of the independent claims reflect that signals (for example, ultrasound beams or waveforms) encoded with complementary Golay codes are transmitted on **spatially adjacent paths**.

As previously discussed, transmission on **spatially adjacent paths**, as opposed to the same path, can provide for simultaneous transmission, which can provide an improvement over known systems that transmit on the same path. For example, transmitting on the same path requires two separate transmissions, increasing the time required to obtain data. Also, double transmission can degrade a frame rate of an imaging system.

Kawagishi discloses a system that can compensate for tissue motion in an observed object between a first ultrasound transmission and a second ultrasound transmission. The tissue motion occurs during a **time difference** between the first and second transmissions. The time difference results from the first and second transmissions being transmitted in the **same direction**. Specifically, Kawagishi states:

> Studies have been made to apply the above pulse compression technique, especially the phase-coded pulse compression technique using a Golay code, to ultrasound diagnosis.
>
> This application is, however, hindered by causes unique to ultrasound diagnosis. The greatest cause is the motion of the tissue (reflecting/scattering body). **The motion of the tissue between two rates causes a phase difference corresponding to the motion between signals with the two rates. As a consequence, range sidelobes remain.**
>
> **In order to solve this problem, a phase change due to the motion of the tissue between the rates must be obtained, and phase compensation must be performed with respect to a pair of reception signals. As a typical method for such operation, a method using a Doppler technique is available, in which**

transmission/reception is repeated at least at two rates, the complex number of a signal with one rate at each depth is multiplied by the complex number of a signal with the other rate at the corresponding depth, and a phase argument is obtained from the multiplication result. In the autocorrelation method, similar processing is performed between a plurality of rates to obtain a complex vector product. This case can be regarded as a special case to which the autocorrelation method is applied, in which the number of data is two. When the obtained phase argument is normalized with 2.pi., and the product of the normalized value and the wavelength of a barycentric frequency representing the fundamental wave is calculated, the displacement of the tissue between the two rates can be obtained.

This phase compensation (motion compensation) technique cannot be applied to the phase-coded pulse compression scheme using a Golay code. Since different transmission waveforms are used, reception signals differ in their waveforms between the rates even if the scattering body remains the same. This makes it impossible to extract only a phase difference due to the motion of the scattering body at each portion between signals.

* * *

During the **time difference** between the first and second rates, the motion of the tissue in the object causes a phase difference corresponding to the motion of the tissue between the first and second reception signals. As described in "Description of the Related Art", this causes range sidelobes.

In this case, the motion of the tissue between the first and second rates is detected as the phase difference between the first and second reception signals. A typical method using a Doppler technique will be described as an example. **Transmission/reception is repeated at two rates in the same direction**, and the complex number of the signal obtained at one rate at each depth is multiplied by the complex number of the signal obtained at the other rate at the corresponding depth. A phase argument is then obtained from the multiplication result. In the autocorrelation method, similar processing is performed between a plurality of rates to obtain a complex vector product. This case can be regarded as a special case to which the autocorrelation

> method is applied, in which the number of data is two. When the obtained phase argument is normalized with 2.pi., and the product of the normalized value and the wavelength of a barycentric frequency representing the fundamental wave is calculated, the displacement of the tissue between the two rates can be obtained. The actual displacement in the living body corresponds to 1/2 the displacement obtained in this case.

Kawagishi, 1:64-2:25, 5:23-61 (emphases added). Kawagishi therefore discloses a system that can compensate for tissue motion that occurs during a **time difference** between first and second transmissions in the **same direction**. However, Kawagishi does not teach or suggest signals (for example, ultrasound beams or waveforms) encoded with complementary Golay codes being transmitted on **spatially adjacent paths**, as recited in the present claims.

Chiao '869 was referenced in the background section of the present application and relates to use of a pair of Golay codes used in two data acquisitions. In prior art systems, such as the one discussed in Chiao '869, Golay coded excitation is done in two acquisitions with a first code in a first acquisition and a second code in a second acquisition. For example, Chiao '869 states at col. 5, lines 12-15 that "[a] pair of Golay-encoded base sequences are transmitted consecutively on each beam, i.e., during first and second firings having the same focal position." *See also* col. 2, lines 32-63 and col. 3, lines 13-20. That is, two beams are transmitted for a particular beam path. Again, using two codes in two acquisitions doubles a time to acquire ultrasound data, and double transmission

degrades a frame rate of an imaging system. For additional explanation, the Applicant respectfully draws the Examiner's attention to Figure 3 and paragraphs [34] and [35] of the present application. Chiao '869 therefore teaches first and second transmissions in the **same direction** and does not teach or suggest signals (for example, ultrasound beams or waveforms) encoded with complementary Golay codes being transmitted on **spatially adjacent paths**, as recited in the present claims.

Similarly, Chiao '618 discusses that transmit waveforms are phase encoded using a two-code pair for each transmit waveform. Chiao '618 states beginning at col. 8, line 64 that for two-transmit code, such as Golay codes, "the transducer elements are pulsed in accordance with a first coded sequence during a first transmit firing focused at a desired transmit focal position and in accordance with a second coded sequence during a second transmit firing focused at the same transmit focal position." Chiao '618 therefore teaches first and second transmissions in the **same direction** and does not teach or suggest signals (for example, ultrasound beams or waveforms) encoded with complementary Golay codes being transmitted on **spatially adjacent paths**, as recited in the present claims.

As discussed above, none of the cited references teach or suggest signals (for example, ultrasound beams or waveforms) encoded with complementary Golay

codes being transmitted on **spatially adjacent paths**, as recited in the present claims. Further, to extent Kawagishi, Chiao '869 and Chiao '618 teach first and second transmissions in the **same direction**, the references teach away from the claimed inventions, which recite transmission on **spatially adjacent paths**. Also, the systems of Kawagishi, Chiao '869 and Chiao '618 should not be modified to arrive at the claimed inventions because doing so would change the principle of operation of the systems disclosed in Kawagishi, Chiao '869 and Chiao '618. The MPEP states:

> If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious.

MPEP § 2143.01. Modifying a system that provides first and second transmissions in the **same direction** to transmit on **spatially adjacent paths** would indeed change the principle of operation of such a system.

For at least the reasons discussed above, Kawagishi, Chiao '869 and Chiao '618, whether taken alone or in combination with each other or the other cited references, cannot anticipate or render obvious independent claims 1, 9 or 14 or claims that depend therefrom. Applicants submit therefore that the pending claims are directed to patentable subject matter.

The Applicant next turns to the rejection of claims 4, 8, and 12 under 35 U.S.C. 103(a) as being unpatentable over Kawagishi in view of Phillips.

As discussed beginning at col. 1, line 12, Phillips relates to systems and methods that utilize coded transmit pulses to enhance imaging characteristics, particularly in motion processing imaging modes. Phillips briefly mentions the use of Golay codes beginning at col. 15, line 37. More particularly, Phillips states that "a second complementary transmit firing, with the expected loss in frame rate, may be used to" address unacceptable range lobes. The two separate outputs resulting from the two transmit firings "can be added before display processing to help suppress the unwanted range lobes." Phillips then cites Golay codes as an example of such a complementary code. Phillips goes on to note at col. 16, lines 8-12 that the transmitted signals should be separated in time to minimize overlap, otherwise undesired terms would appear in the harmonic signals. Thus, Phillips use of Golay codes is similar to other prior art systems such as those discussed above, involving firing two complementary-coded beams on the same beam path.

As discussed above, amended independent claims 1 and 9 recite encoding ultrasound beams using complementary Golay codes and transmitting the ultrasound beams on **spatially adjacent paths**, rather than transmitting two beams on the **same path** to acquire ultrasound data as discussed by Kawagishi and Phillips. In addition, neither Kawagishi nor Phillips, teach or suggest processing

echo signals from such encoded ultrasound beams on spatially adjacent paths to form an ultrasound line as recited in claims 1 and 9.

Therefore, Applicants respectfully submit that independent claims 1 and 9 and claims that depend therefrom should be allowable over the cited art of record for at least the reasons discussed above.

The Applicant next turns to the rejection of claims 5, 6, and 13 under 35 U.S.C. 103(a) as being unpatentable over Chiao '869. Chiao '869 fails to teach the entirety of the limitations recited in amended independent claims 1 and 9 for at least the reasons discussed above. Claims 5, 6, and 13 depend from independent claims 1 and 9. Therefore, the Applicant respectfully submits that because claims 1 and 9 should be allowed for at least the reasons discussed above, claims 5, 6, and 13 should also be allowed.

In addition, in the Office Action on pages 3-4, it appears that the Examiner is taking Official Notice in rejecting claims 5, 6, and 13. The Examiner has made statements that, because of the manner in which the statements are worded, could be interpreted as the Examiner asserting Official Notice of the subject of the statements. If the Examiner is asserting Official Notice that the subject of the statements are common knowledge, the Applicant respectfully traverses the Examiner's assertions as further set forth below. Alternatively, if the Examiner's

assertions are based on the personal knowledge of the Examiner, then under MPEP § 2144.03(C) and 37 C.F.R. § 1.104(d)(2), the Examiner's assertions must be supported by an affidavit from the Examiner.

According to MPEP § 2144.03(A), Official Notice, without supporting references, should only be asserted when the subjects asserted to be common knowledge are "capable of instant and unquestionable demonstration as being well-known." That is, the subjects asserted must be of "notorious character" under MPEP § 2144.03(A).

However, the Applicant respectfully submits that the subject matter of the Examiner's assertion of Official Notice is not well-known in the art as evidenced by the searched and cited prior art. The Applicant respectfully submits that the Examiner has performed "a thorough search of the prior art," as part of the Examiner's obligation in examining the present application under MPEP § 904.02.

Additionally, the Applicant respectfully submits that the Examiner's searched and cited references found during the Examiner's thorough and detailed search of the prior art are indicative of the knowledge commonly held in the art. However, in the Examiner's thorough and detailed search of the relevant prior art, none of the prior art taught or suggested the subject matter of the Examiner's assertion of Official Notice. The Applicant respectfully submits that if the subject matter of the Examiner's assertion of Official Notice had been of "notorious

character" and "capable of instant and unquestionable demonstration as being well-known" under MPEP § 2144.03(a), then the subject matter would have appeared to the Examiner during the Examiner's thorough and detailed search of the prior art.

If the Examiner had found any teaching of relevant subject matter, the Examiner would have been obligated to list the references teaching the relevant subject matter and make a rejection. Consequently, the Applicant respectfully submits that the prior art does not teach the subject matter of the Examiner's assertion of Official Notice and respectfully traverses the Examiner's assertion of Official Notice.

In addition, the Examiner has not made any showing that the subject matter of the Examiner's assertion of Official Notice was well-known in the art at the time the invention was made, as required under MPEP § 2141.01(III). Specifically, MPEP § 2141.01(III) specifically states that the content of the prior art is determined at the time the invention was made in order to avoid impermissible hindsight. MPEP § 2141.01(III) states that "It is difficult but necessary that the decisionmaker forget what he or she has been taught . . . about the claimed invention and cast the mind back to the time the invention was made (often as here many years)." Consequently, the Examiner must establish that the subject matter of the Examiner's assertion of Official notice was well-known in the art when the present invention was made, rather then that the subject matter is

well-known at the present time, in order to comply with MPEP § 2141.01(III) and avoid the use of impermissible hindsight. The Applicant respectfully submits that even if the subject matter of the Examiner's assertion of Official Notice is presently well-known, the Examiner has presented no evidence that the subject matter was well-known at the time that the present invention was made.

The Applicant specifically challenges the Examiner's assertion of Official Notice with regard to the following:

> "Although Chiao '869 fails to disclose or fairly suggest use of lateral filtering on the echo signals, Chiao '869 teaches a method wherein finite impulse response (FIR) was applied for filtering (See Col. 5, line 31-36), therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to perform the method of averaging the echo signals and higher order finite impulse response (FIR), by lateral filtering, in order to improve the method and apparatus of ultrasounds imagining wherein the signal to noise ration (SNR) is reduced."

As stated above, the Applicant respectfully traverses the Examiner's assertions of Official Notice and submits that the subject matter is not of such "notorious character" that it is "capable of instant and unquestionable demonstration as being well-known." More particularly, the Applicant respectfully assert that a discussion in Chiao '869 of using an FIR for filtering does not make it obvious to one of ordinary skill in the art to perform the method of averaging the echo signals and higher order FIR by lateral filtering in order to improve ultrasound imagining wherein the SNR is reduced. Under MPEP 2144.03, the

Examiner is now obligated to provide a reference(s) in support of the assertion of Official Notice if the Examiner intends to maintain any rejection based on the assertion of Official Notice. Additionally, the Applicant respectfully requests the Examiner reconsider the assertion of Official Notice and provide to Applicant any basis for the Examiner's assertion of Official Notice.

CONCLUSION

If the Examiner has any questions or the Applicants can be of any assistance, the Examiner is invited and encouraged to contact the Applicants' undersigned attorney at (312) 775-8096.

The Commissioner is authorized to charge any additional fees or credit overpayment to the Deposit Account of GEMS-IT, Account No. 50-2401.

Respectfully submitted,

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